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TECHNICAL REPORT RK-85-1

CHARACTERIZATION STANDARDS FOR
SOLID PROPELLANT ROCKET MOTORS

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Propulsion Directorate
US Army Missile Laboratory

OCTOBER 1984

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This document sets standards for the characterization of solid propellant rocket motor propulsion systems. The characteristics are presented as a check list for ten different component parts including the overall propulsion system, analysis, the rocket motor case, nozzle, propellant, liner, insulation, igniter, ingredients, and energy management. The characterization of a propulsion system is invariably limited by available time, manpower, funding, and other resources. However, the enclosed listing attempts to identify the characteristics, properties, required tests, and information which would make up the data base for a		

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fully characterized solid rocket propulsion system. The list recognizes that different degrees of characterization would be required at different stages in the evolution of a propulsion system. The characterizations for an initial effort (as in the research or concept phase) might be distinctly different from the characterization done late in the evolution and just prior to production.

ACKNOWLEDGEMENTS

A large number of people played a part in the writing of these standards. In particular, the scientific and engineering personnel as well as the functional management personnel in the Propulsion Directorate have been very helpful over the extended period of time during which conferences and negotiations were held in order to establish the list. These people deserve a special note of thanks since they constitute a group of dedicated professionals who have set out a list by which their own performance can be judged, as well as that of other organizations.



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FORWARD

I. INTRODUCTION AND BACKGROUND

In early 1983, Robert L. Moore was Commanding General of the Army Missile Command at Redstone Arsenal, Alabama. In a briefing for General Moore, it became apparent that a particular missile system had reached a fairly advanced stage in its evolutionary process without certain important tests having been performed on the rocket motor. General Moore asked if these tests were not an inherent part of the characterization of a solid propellant rocket motor. This question prompted an introspective analysis as to exactly what constituted the testing and evaluation required for a fully characterized solid propellant rocket motor, and also prompted a consideration of what reasons there might be for having a missile program reach an advanced level of maturity without complete characterization. The answers to the second question were multiple. Insufficient funding, insufficient time, lack of professional understanding of the degree of characterization necessary, etc., all are true to some extent in the development of any propulsion system. Answers to the first question, namely, "What constitutes a fully characterized propulsion system?" are more difficult to come by.

An answer to this question in general terms relating to a variety of different types of propulsion systems would be extremely difficult. This document is the product of a committee working at the Propulsion Directorate, US Army Missile Laboratory, US Army Missile Command, which has considered the question, and attempted to address it in a limited scope, in the context of today's technology.

II. CHARACTERIZATION STANDARDS

This booklet contains a check list of information tests, and facts, which is to serve as a standard for the characterization of a solid rocket motor propulsion system. The term "characteristic", for this purpose, means a property of the system, and the requirement for each item will depend on the system application. Given sufficient resources, the Army Missile Laboratory would certify a propulsion system ready for production after the following characteristics were known. It should be recognized that there are different ways of obtaining information relating to a particular characteristic, and that this document does not address the best methods for obtaining that type of information. In some instances, this is a matter of opinion, and can be debated with some merit between different laboratory organizations which view the problem from different perspectives. The list was compiled in order to answer the question "In the ideal case, what characteristics do you wish to have fully understood before you will certify a propulsion system as ready for production and deployment?". Planning for this document began in the second half of 1983 and continued through the first quarter of 1984. A large number of scientific and engineering personnel from the Propulsion Directorate were involved in an extensive series of conversations to generate the list of characterization standards.

III. INTENDED USE

This list may be used as a yardstick to determine how well a system is characterized. Engineering judgement is required in applying the standards, and should be based on factors such as system application, size, cost, etc. In the process of development, a responsible principle investigator can use the list to assess progress in the characterization of a potential new system. Failure investigations and root cause investigations invariably reveal that certain characteristics of the propulsion system were not present in the data base supporting the readiness of the system.

This document should be considered as a first step in attempting to enumerate the characterization standards of propulsion systems. As newer tests are developed, and newer methods of characterization are discovered, the characterization process can be expected to change. For this reason, future additions of this list will appear, along with expansion to include liquid, hybrid, and air breathing propulsion.

IV. HOW TO USE THE LIST

The subject matter of solid rocket propulsion systems has been subdivided into ten different chapters (see Table of Contents). Beside each characteristic is a progressive sequence which describes, in general, the evolutionary process of propulsion and propulsion components. These stages are identified as the concept and research stage, the exploratory development phase, the advanced development phase, the engineering development phase, and production. In some cases, a certain set of characterization tests is much too expensive to conduct in the early phases of investigation. As a result, abbreviated testing methods are sometimes used in the early stages, and more comprehensive testing methods are used in the latter stages. That is to say, there are different degrees of characterization which may be done at different stages of maturity of the particular product. These different stages of maturity are indicated by placing appropriate designators in the columns to the right of the list.

An X in a specific column means that this characteristic should be determined prior to entering the next phase in the evolutionary process. An X* means "as applicable". A series of capital X's running across several columns means that this is normally a continuing activity which lasts through several phases of development.

APPENDIX 1.0

PROPULSION SYSTEM CHARACTERISTICS

1.0 PROPULSION SYSTEM CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
1.1 BALLISTIC CHARACTERIZATION					
1.1.1 PROPELLANT BALLISTICS		X			
1.1.2 HEAVY WALL FULL SCALE		X*			
1.1.3 FLIGHT TEST CHARACTERISTICS		X*	X*		
1.1.4 FLIGHT WEIGHT		X*	X		
1.1.5 PULSE STABILITY CHARACTERISTICS		X*	X*		
1.1.6 WATERFALL PLOT TESTS		X*	X		
1.2 IGNITION CHARACTERIZATION					
1.2.1 SIMULATED CAVITY		X*	X		
1.2.2 LIVE PROPELLANT		X*	X		
1.3 SPIN TEST CHARACTERISTICS					
1.3.1 STATIC ROTATION			X*	X*	
1.3.2 AXIAL/NORMAL CENTRIFUGE			X*	X*	

1.0 PROPULSION SYSTEM CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
1.4 SIGNATURE CHARACTERIZATION					
1.4.1 SMOKE TUNNEL TRANSMISSION		X*	X*		
1.4.2 ENCLOSURE NOISE			X*		
1.4.3 FULL SCALE			X*		
1.4.4 FLIGHT			X*		
1.5 MOTOR SYSTEM CHARACTERISTICS					
1.5.1 PROOF OF DESIGN		X*	X*	X*	
1.5.2 STATISTICAL CHARACTERIZATION				X	
1.5.3 THERMAL CHARACTERISTICS		X*	X*	X	
1.5.4 MASS CHARACTERISTICS		X*	X*	X	
1.5.5 ASSEMBLY AND ALIGNMENT CHARACTERISTICS		X*	X*	X	
1.5.6 PHYSICAL AND FUNCTIONAL CHARACTERISTICS AUDIT				X	
1.5.7 PRODUCTION READINESS REVIEW				X	

1.0 PROPULSION SYSTEM CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
1.6 COST CHARACTERISTICS					
1.6.1 PARAMETRIC ESTIMATES		X*			
1.6.2 SHOULD-COST				X	
1.6.3 DTUPC			X		
1.7 PRODUCTION ENGINEERING & PRODUCIBILITY				X	
1.8 PROPULSION SYSTEM REQUIREMENTS					
1.8.1 CRITICAL ITEMS DEVELOPMENT SPEC			X		
1.8.2 PRODUCTION DEVELOPMENT SPEC				X	
1.9 REPRODUCIBILITY TESTING		X*	X*	X*	
1.10 ENVIRONMENTAL CHARACTERISTICS (AR 70-38 and MIL-STD 510C)			X*	X	
1.11 SAFETY TESTS				X	
1.12 MAN RATING				X	
1.13 FEMA TESTING				X	
1.14 AGING AND SERVICE LIFE			X	X	X

APPENDIX 2.0
ANALYTICAL CHARACTERISTICS

2.0 ANALYTICAL CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
2.1 PRELIMINARY DESIGN CHARACTERISTICS					
2.1.1 PARAMETRICS		X			
2.1.2 DESIGN POINT LAYOUT		X			
2.2 THERMO-CHEMICAL EQUILIBRIUM		X			
2.3 PRODUCTION COST ESTIMATE					
2.3.1 PARAMETRIC		X			
2.3.2 DETAILED ENGINEERING			X	X	X
2.4 INTERIOR BALLISTICS					
2.4.1 KN TYPE		X			
2.4.2 STANDARD PERFORMANCE PREDICTION (OR EQUIVALENT)		X*	X	X	
2.4.3 UNSTEADY STATE CHARACTERISTICS		X*	X*	X*	
2.5 STABILITY ANALYSIS					
2.5.1 GUIDELINES		X			
2.5.2 STANDARD STABILITY PREDICTION (OR EQUIVALENT)			X	X	

2.0 ANALYTICAL CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
2.6 IMPULSE ERROR BUDGET/REPRODUCIBILITY (FOR FREE FLIGHT ROCKET)			X	X	
2.7 THRUST MISALIGNMENT BUDGET			X	X	
2.8 SIGNATURE CHARACTERISTICS					
2.8.1 PLUME FLOW FIELD			X*		
2.8.2 TRANSMISSIBILITY		X*	X*		
2.9 STRUCTURAL ANALYSIS					
2.9.1 MEMBRANE ANALYSIS		X			
2.9.2 PLANE-STRAIN FOR GRAIN		X			
2.9.3 FINITE ELEMENT ANALYSIS			X*		
2.9.4 COMPONENT MARGIN OF SAFETY			X	X	
2.9.5 CASE-GRAIN INTERACTION			X	X	
2.9.6 VISCO-ELASTIC DYNAMIC ANALYSIS			X	X	

2.0 ANALYTICAL CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
2.10 THERMAL ANALYSIS					
2.10.1 I-D HEAT TRANSFER		X			
2.10.2 THERMAL ANALYSIS OF EXPOSED SURFACES			X	X	
2.10.3 COMBINED THERMAL AND PRESSURE IN NOZZLE			X	X	
2.10.4 PARTICLE IMPINGEMENT			X*		
2.11 FAILURE EFFECTS MODES ANALYSIS				X	

3.0 MOTOR CASE CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.1 RAW MATERIAL CHARACTERISTICS	X				
3.1.1 CHEMICAL CHARACTERISTICS	X				
3.1.1.1 COMPOSITION	X				
3.1.1.2 ANALYSIS METHOD	X				
3.1.1.3 SOURCE	X				
3.1.1.4 AVAILABILITY	X				

APPENDIX 3.0
MOTOR CASE CHARACTERISTICS

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.1.2 PHYSICAL CHARACTERISTICS	X				
3.1.2.1 COEFFICIENT OF THERMAL EXPANSION	X				
3.1.2.2 DENSITY	X				
3.1.2.3 THERMAL CONDUCTIVITY	X				
3.1.2.4 SPECIFIC HEAT	X				
3.1.2.5 MAGNETIC PROPERTIES	X				
3.1.2.6 MELTING POINT	X				
3.1.2.7 ELECTRICAL RESISTANCE	X				
3.1.2.8 THERMAL DIFFUSIVITY	X				
3.1.2.9 THERMAL PROPERTIES	X				
3.1.2.10 SOURCE	X				
3.1.2.11 ISENTROPIC PROPERTIES	X				

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.1.3 MECHANICAL CHARACTERISTICS					
3.1.3.1 ULTIMATE TENSILE STRENGTH	X				
3.1.3.2 YIELD STRENGTH	X				
3.1.3.3 ELONGATION	X				
3.1.3.4 REDUCTION OF AREA	X				
3.1.3.5 IMPACT STRENGTH	X				
3.1.3.6 HARDNESS	X				
3.1.3.7 COMPRESSIVE STRENGTH	X*				
3.1.3.8 TORSION STRENGTH	X*				
3.1.3.9 SHEAR STRENGTH	X				
3.1.3.10 BEARING STRENGTH	X*				
3.1.3.11 BENDING	X*				
3.1.3.12 FATIGUE	X*				
3.1.3.13 CREEP	X*				
3.1.3.14 MODULUS, TENSILE/SHEAR	X				

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADY DEV	ENG DEV	LMTD PROD
3.1.3 MECHANICAL CHARACTERISTICS (CONTD)					
3.1.3.15 POISSON'S RATIO	X				
3.1.3.16 TOUGHNESS, FRACTURE (CRITICAL FLAW SIZE)	X				
3.1.3.17 TEMP EFFECT ON PROPERTIES		X			
3.1.3.18 RATE EFFECT ON PROPERTIES		X*			
3.1.3.19 CONSIDER DIRECTIONALITY		X*			
3.1.3.20 CONSTITUENT	X*				
3.1.3.21 LAMINA PROPERTIES	X*				
3.1.3.22 LAMINATE PROPERTIES	X*				

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.1.4 METALLURGICAL CHARACTERISTICS	X				
3.1.4.1 MICRO	X				
3.1.4.2 MACRO	X				
3.1.4.3 MELTING PRACTICE	X				
3.1.4.4 FORMING PRACTICE	X				
3.1.4.5 FINISHING PRACTICE	X				
3.1.4.6 WELDING PRACTICE	X				
3.1.4.7 THERMAL TREATMENT	X				
3.1.5 COMPOSITE CHARACTERISTICS	X				
3.1.5.1 MICRO	X				
3.1.5.2 MACRO	X				
3.1.5.3 FABRICATION PRACTICE	X				
3.1.5.4 FINISHING PRACTICE	X				
3.1.5.5 THERMAL TREATMENT	X				

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.1.6 ENVIRONMENTAL CHARACTERISTICS	X				
3.1.6.1 EXTERNAL	X				
3.1.6.2 INTERNAL	X				
3.1.6.3 REGULATIONS	X				
3.1.7 SPECIFICATIONS FOR THE MATERIAL		X			
3.1.7.1 TYPE REQUIRED		X			
3.1.7.2 WHEN REQUIRED		X			
3.1.7.3 WHERE REQUIRED		X			
3.1.8 COST CHARACTERISTICS	X				
3.1.8.1 RAW MATERIAL	X				

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.2 DESIGN CHARACTERISTICS					
3.2.1 STRUCTURAL ANALYSIS					
3.2.1.1 DESIGN ANALYSIS		X*	X*	X*	
3.2.1.2 FAILURE MODE		X*	X*	X*	
3.2.1.3 MARGIN OF SAFETY		X*	X*	X*	
3.2.1.4 METHODOLOGY		X*	X*	X*	
3.2.1.5 2, 5, 12 TERM STIFFNESS MATRIX		X*	X*	X*	
3.2.2 DESIGN COST CHARACTERISTICS					
3.2.2.1 PROPERTIES VS PERFORMANCE		X*			
3.2.2.2 SPECIFICATION NEEDS			X		
3.2.2.3 MODEL TRADE-OFFS		X*	X		
3.2.2.4 DTUPC GOAL			X		

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.3 IN-PROCESS CHARACTERISTICS					
3.3.1 ANALOGS FOR PROCESS EFFECTS		X*			
3.3.2 PHYSICAL		X*			
REFERENCE 3.1.2 ABOVE					
3.3.3 MECHANICAL		X*			
REFERENCE 3.1.3 ABOVE					
3.3.4 METALLURGICAL		X*			
REFERENCE 3.1.4 ABOVE					
3.3.5 COMPOSITE PROPERTIES		X*			
REFERENCE 3.1.5 ABOVE					
3.3.6 COST		X*			
REFERENCE 3.1.8 AND 3.2.2 ABOVE					

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.4 COMPONENT CHARACTERISTICS					
3.4.1 FULL SCALE STRUCTURAL					
3.4.1.1 PROOF TEST CHARACTERISTICS		X*			
3.4.1.2 HYDROSTATIC BURST TEST		X*			
3.4.1.3 OVER TEST (INCLUDING HOT GAS BURST)		X*			
3.4.1.4 EXTERNAL LOAD TESTS		X*			
3.4.1.5 TEST INDUCED DEGRATATION CHARACTERISTICS		X*			
3.4.1.6 POST STRUCTURAL EVALUATION		X*			
3.4.2 SYSTEM COMPATIBILITY					
3.4.2.1 INTERNAL (INCLUDING E.G. STRESS CORROSION)			X*		
3.4.2.2 FITTINGS & ATTACHMENTS (STRESS CORROSION)			X*		
3.4.2.3 COATINGS AND PROTECTIVE FINISHES			X*		
3.4.3 MOTOR QUALIFICATION				X	
3.4.4 FINAL DATA PACKAGE				X	

3.0 MOTOR CASE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
3.4 COMPONENT CHARACTERISTICS (CONTD)					
3.4.5 SERVICE LIFE					
3.4.5.1 ANALOG		X*			
3.4.5.2 FULL SCALE			X*	X	
3.4.6 NON-DESTRUCTIVE					
3.4.6.1 TYPE TEST/ACCEPTANCE CRITERIA				X	
3.4.6.2 NUMBER OF TESTS				X	
3.4.7 COST					
3.4.7.1 DTUPC				X	
3.4.7.2 PRODUCTION COST CHARACTERISTICS					X*

APPENDIX 4.0
NOZZLE CHARACTERISTICS

4.0 NOZZLE CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1 RAW MATERIAL CHARACTERISTICS	X				
4.1.1 CHEMICAL CHARACTERISTICS	X				
4.1.1.1 COMPOSITION	X				
4.1.1.2 ANALYSIS METHOD	X				
4.1.1.3 SOURCE	X				
4.1.1.4 AVAILABILITY	X				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1.2 PHYSICAL CHARACTERISTICS	X				
4.1.2.1 COEFFICIENT OF THERMAL EXPANSION	X				
4.1.2.2 DENSITY	X				
4.1.2.3 THERMAL CONDUCTIVITY	X				
4.1.2.4 SPECIFIC HEAT	X				
4.1.2.5 MAGNETIC PROPERTIES	X				
4.1.2.6 MELTING POINT	X				
4.1.2.7 ELECTRICAL RESISTANCE	X				
4.1.2.8 THERMAL DIFFUSIVITY	X				
4.1.2.9 THERMAL PROPERTIES	X				
4.1.2.10 SOURCE	X				
4.1.2.11 NONUNIFORM CHARACTERISTICS	X				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1.3 MECHANICAL CHARACTERISTICS					
4.1.3.1 ULTIMATE TENSILE STRENGTH	X				
4.1.3.2 YIELD STRENGTH	X				
4.1.3.3 ELONGATION	X				
4.1.3.4 REDUCTION OF AREA	X				
4.1.3.5 IMPACT STRENGTH	X				
4.1.3.6 HARDNESS	X				
4.1.3.7 COMPRESSIVE STRENGTH	X*				
4.1.3.8 TORSION STRENGTH	X*				
4.1.3.9 SHEAR STRENGTH	X*				
4.1.3.10 BEARING STRENGTH	X*				
4.1.3.11 BENDING	X*				
4.1.3.12 FATIGUE	X*				
4.1.3.13 CREEP	X*				
4.1.3.14 MODULUS, TENSILE/SHEAR	X				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1.3 MECHANICAL CHARACTERISTICS (CONTD)					
4.1.3.15 POISSON'S RATIO	X				
4.1.3.16 TOUGHNESS, FRACTURE (CRITICAL FLAW SIZE)	X				
4.1.3.17 THERMAL EFFECTS		X			
4.1.3.18 RATE EFFECTS		X*			
4.1.3.19 CONSIDER DIRECTIONALITY		X*			
4.1.3.20 CONSTITUENT	X*				
4.1.3.21 LAMINA	X*				
4.1.3.22 LAMINATE	X*				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1.4 METALLURGICAL CHARACTERISTICS	X				
4.1.4.1 MICRO	X				
4.1.4.2 MACRO	X				
4.1.4.3 MELTING PRACTICE	X				
4.1.4.4 FORMING PRACTICE					
4.1.4.5 FINISHING PRACTICE	X				
4.1.4.6 WELDING PRACTICE	X				
4.1.4.7 THERMAL TREATMENT	X				
4.1.5 COMPOSITE CHARACTERISTICS	X				
4.1.5.1 MICRO	X				
4.1.5.2 MACRO	X				
4.1.5.3 FABRICATION PRACTICE	X				
4.1.5.4 FINISHING PRACTICE	X				
4.1.5.5 THERMAL TREATMENT	X				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.1.6 ENVIRONMENTAL CHARACTERISTICS	X				
4.1.6.1 EXTERNAL	X				
4.1.6.2 INTERNAL	X				
4.1.6.3 REGULATIONS	X				
4.1.7 SPECIFICATIONS FOR THE MATERIAL		X			
4.1.7.1 TYPE REQUIRED		X			
4.1.7.2 WHEN REQUIRED		X			
4.1.7.3 WHERE REQUIRED		X			
4.1.8 COST CHARACTERISTICS	X				
4.1.8.1 RAW MATERIAL	X				

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD FROD
4.2.0 DESIGN CHARACTERISTICS					
4.2.1 STRUCTURAL ANALYSIS					
4.2.1.1 DESIGN ANALYSIS		X*	X*	X*	
4.2.1.2 FAILURE MODE		X*	X*	X*	
4.2.1.3 MARGIN OF SAFETY		X*	X*	X*	
4.2.1.4 METHODOLOGY		X*	X*	X*	
4.2.1.5 2, 5, 12 TERM STIFFNESS MATRIX		X*	X*	X*	
4.2.2 DESIGN COST CHARACTERISTICS					
4.2.2.1 PROPERTIES VS PERFORMANCE		X*			
4.2.2.2 SPECIFICATION NEEDS			X		
4.2.2.3 MODEL TRADE-OFFS		X*	X		
4.2.2.4 DTUPC GOAL			X		

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.3.0 IN-PROCESS CHARACTERISTICS					
4.3.1 ANALOGS FOR PROCESS EFFECTS		X*			
4.3.2 PHYSICAL		X*			
REFERENCE 4.1.2 ABOVE					
4.3.3 MECHANICAL		X*			
REFERENCE 4.1.3 ABOVE					
4.3.4 METALLURGICAL		X*			
REFERENCE 4.1.4 ABOVE					
4.3.5 COMPOSITE PROPERTIES		X*			
REFERENCE 4.1.5 ABOVE					
4.3.6 COST		X*			
REFERENCE 4.1.8 AND 4.2.2 ABOVE					

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.4.0 COMPONENT CHARACTERISTICS					
4.4.1 FULL SCALE STRUCTURAL					
4.4.1.1 PROOF TEST CHARACTERISTICS		X*			
4.4.1.2 HYDROSTATIC BURST TEST		X*			
4.4.1.3 OVER TEST (INCLUDING HOT GAS BURST)		X*			
4.4.1.4 EXTERNAL LOAD TESTS		X*			
4.4.1.5 TEST INDUCED DEGRADATION CHARACTERISTICS		X*			
4.4.1.6 POST STRUCTURAL EVALUATION		X*			
4.4.2 SYSTEM COMPATIBILITY					
4.4.2.1 INTERNAL (INCLUDING, E.G. STRESS CORROSION)			X*		
4.4.2.2 FITTINGS & ATTACHMENTS (STRESS CORROSION)			X*		
4.4.2.3 COATINGS AND PROTECTIVE FINISHES			X*		
4.4.3 MOTOR QUALIFICATION				X	
4.4.4 FINAL DATA PACKAGE				X	

4.0 NOZZLE CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
4.4.0 COMPONENT CHARACTERISTICS (CONTD)					
4.4.5 SERVICE LIFE					
4.4.5.1 ANALOG		X*			
4.4.5.2 FULL SCALE			X*	X	
4.4.6 NON-DESTRUCTIVE					
4.4.6.1 TYPE TEST/ACCEPTANCE CRITERIA				X	
4.4.6.2 NUMBER OF TESTS				X	
4.4.7 COST					
4.4.7.1 DTUPC				X	
4.4.7.2 PRODUCTION COST CHARACTERISTICS					X*

APPENDIX 5.0
PROPELLANT CHARACTERISTICS

5.0 PROPELLANT CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.1 GENERAL CHARACTERISTICS					
5.1.1 COMPOSITION		X	X*		
5.1.2 REPRODUCIBILITY POTENTIAL (STATISTICAL EVALUATION)			X	X*	
5.1.3 FABRICATION CHARACTERISTICS					
5.1.3.1 PROCESSING PROCEDURES				X	X
ORDER/RATE OF ADDITION		X	X	X	X
MIX TEMP EFFECTS		X	X	X	X
5.1.3.2 EOM VISCOSITY		X	X	X	X
5.1.3.3 POT LIFE		X	X	X	X
FACTORS INFLUENCING POT LIFE		X	X	X	X
5.1.3.4 CURE TIME & TEMPERATURE CHARACTERISTICS		X	X	X	X
5.1.3.5 EFFECT ON PROPELLANT OF CURE ENVIRONMENT					X
5.1.3.6 CURE SHRINKAGE			X	X	X
5.1.3.7 INGREDIENT SPECS (SEE 9.0)					X
5.1.3.8 PROPELLANT SPECS				X	X

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.1.3.9 SCALE EFFECTS		X	X	X	X
5.1.3.10 Q C PROCEDURES					X
5.1.3.11 RHEOLOGY CHARACTERISTICS		X	X	X	X
5.1.3.12 MOTOR PREP PROCEEDURES				X	X
CASTING PROCEEDURES				X	X
TRIMING PROCEEDURES				X	X
INSPECTION PROCEEDURES				X	X
5.1.3.13 PRODUCTIBILITY CHARACTERISTICS		X	X*	X*	X*
5.1.3.14 INGREDIENT PREPARATION					

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.1.4 MECHANICAL PROPERTY CHARACTERISTICS					
5.1.4.1 UNIAXIAL TENSILE PROPERTIES		X	X*	X*	X*
CONSTANT RATE		X	X*	X*	X*
STRESS/STRAIN/MODULUS		X	X*	X*	X*
SMITH FAILURE ENVELOPE			X	X*	X*
STRAIN ENDURANCE			X		
TIME-TO-FAILURE DISTRIBUTION			X		
RELAXATION MODULUS			X		
COHESIVE FRACTURE ENERGY			X		
LOW TEMP IGNITION STRESS & STRAIN CAPABILITY			X*	X	
CREEP PROPERTIES DETERMINED			X		
CHARACTERISTICS OF THE ABOVE PROPERTIES AS INFLUENCED BY:					
TEST RATE			X		
TEMPERATURE			X		
HUMIDITY			X		

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.1.4.2 MULTIAXIAL TENSILE PROPERTIES					
BIAXIAL			X		
TRIAxIAL			X		
SHEAR			X		
5.1.4.3 COMPRESSIVE PROPERTIES			X*		
5.1.4.4 HARDNESS, SHORE A		X	X*	X*	X*
5.1.4.5 STRESS/STRAIN ANALYSIS OF MOTOR AND GRAIN			X	X*	X*
5.1.5 PHYSICAL PROPERTY CHARACTERISTICS					
5.1.5.1 DENSITY	X*	X			
5.1.5.2 COEFF OF LINEAR EXPANSION	X*	X			
5.1.5.3 THERMAL CONDUCTIVITY		X			
5.1.5.4 HEAT CAPACITY		X			
5.1.5.5 OPTICAL PROPERTIES		X*	X		
5.1.5.6 SOLUBILITY OF INGREDIENTS AND CONTAMINANTS	X*	X			
5.1.5.7 PERMEABILITY/DIFFUSIVITY OF INGREDIENTS & CONTAMINANTS		X			

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.1.5.8 GLASS TRANSITION TEMP		X			
5.1.5.9 HYDROSTATIC COMPRESSABILITY			X		
5.1.6 HAZARD CLASSIFICATIONS					
5.1.6.1 DOT CLASS		X*	X		
5.1.6.2 MIL STORAGE CLASS CHARACTERISTICS		X*	X		
5.1.6.3 HAZARD (STAHAG 4123-SEE ALSO SEC. I-PROPULSION)		X*	X		
5.1.7 DEMILITARIZATION PROCEEDURES				X	
5.1.8 RECLAMATION PROCEEDURES				X	
5.1.9 DISPOSAL PROCEEDURES				X	
5.1.10 NBC SURVIVABILITY AND BEHAVIOR		X*	X*	X	
5.1.11 INSTALLED COST		X*	X		

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.2.1 AGING CHARACTERISTICS					
5.2.1.1 AGING WITH INTERNAL AND EXTERNAL MOISTURE			X		
5.2.1.2 TEMPERATURE CYCLING		X*	X		
5.2.1.3 LONG TERM HOT		X*	X		
5.2.1.4 LONG TERM COLD		X*	X		
5.2.1.5 MECHANICAL PROPERTIES					
UNIAXIAL TENSILE PROPERTIES					
CONSTANT RATE STRESS, STRAIN, & MODULUS				X	
SMITH FAILURE CURVE				X	
STRAIN ENDURANCE				X	
TIME-TO-FAILURE DISTRIBUTION				X*	
RELAXATION MODULUS				X	
COHESIVE FRACTURE ENERGY				X*	
LOW TEMP IGNITION STRESS & STRAIN CAPABILITY				X*	
CREEP PROPERTIES				X	

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
CHARACTERISTICS OF THE ABOVE PROPERTIES AS AFFECTED BY:					
TEST RATE				X	
TEMP				X	
HUMIDITY				X	
MULTIAXIAL TENSILE PROPERTIES					
BIAXIAL				X	
TRIAXIAL				X	
SHEAR				X	
5.2.1.6 PHYSICAL PROPERTIES					
SOLUBILITY OF INGREDIENTS				X*	
PERMIABILITY/DIFFUSIVITY OF INGREDIENTS & CONTAMINANTS				X*	

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.2.1.7 CHEMICAL PROPERTIES					
STABILIZER DEPLETION		X*	X		
DTA/DSC		X*	X		
COOK OFF		X*	X		
OFF GAS ANALYSIS		X*	X		
GAS EVOLUTION RATE		X*	X		
CROSS LINK DENSITY		X*	X		
5.2.1.8 SAFETY CHARACTERISTICS					
FRICTION SENSITIVITY			X*	X	
IMPACT SENSITIVITY			X*	X	
ELECTROSTATIC DISCHARGE SENSITIVITY			X*	X	
CARD GAP TEST			X*	X	
5.2.1.9 BALLISTIC PROPERTIES					
IGNITION CHARACTERISTICS			X*	X	

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.3.1 CHEMICAL CHARACTERISTICS					
5.3.1.1 COMPATABILITY (STANAG 4147)					
INGREDIENTS	X*	X			
MATERIALS OF CONSTRUCTION	X*	X			
5.3.1.2 STABILITY TEST					
DTA/DSC		X			
COOK OFF/AUTOIGNITION		X			
OFF GAS ANALYSIS		X			
AUTOCATALYSIS		X			
GAS EVOLUTION RATE		X			
5.3.1.3 MIGRATION (INTO/OUT OF/ WITHIN GRAIN)					
BALLISTIC EFFECT		X*	X		
MECHANICAL EFFECT		X*	X		

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.3.1.4 TOXICITY					
INGREDIENTS TOXICITY	X				
MANUFACTURING EXPOSURES			X*	X	
STORAGE EXPOSURES				X	
USE EXPOSURES				X	
5.3.1.5 CROSS LINK DENSITY		X*	X	X*	X*

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.4.1 PERFORMANCE CHARACTERISTICS					
5.4.1.1 PARAMETRICS EVALUATED		X			
5.4.1.2 SPECIFIC HEAT (γ)		X			
5.4.1.3 BALLISTIC PROPERTIES					
P K R		X			
n		X			
Pi sub K		X			
C*		X			
Isp		X			
Id (DENSITY IMPULSE)		X			
ERROSIVE BURNING			X*		
SLOPE CHANGES		X			
MIN/MAX PRESSURE		X			
FLAME TEMP	X				
ACCELERATION EFFECTS			X*		

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.4.1.3 BALLISTIC PROPERTIES (CONTD)					
STRAIN EFFECTS			X*		
5.4.1.4 HEAT OF EXPLOSION		X			
5.4.1.5 ACOUSTIC STABILITY CHARACTERISTICS			X*		
5.4.1.6 EXHAUST PRODUCTS					
GASSES		X			
SMOKE		X			
EM SIGNATURE (ABSORPTION/ EMISSION)		X			
5.4.1.7 OPERATIONAL/STORAGE TEMP RANGE CHARACTERISTICS			X		

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.5.1 SAFETY CHARACTERISTICS (UNAGED)(AOP-15)					
5.5.1.1 FRICTION SENSITIVITY		X			
5.5.1.2 IMPACT SENSITIVITY		X			
5.5.1.3 ELECTROSTATIC DISCHARGE SENSITIVITY		X			
5.5.1.4 EASE OF IGNITION (HOT WIRE) AT SEVERAL TEMP		X			
5.5.1.5 EXPLOSIVE RESPONSE FOR:					
UNCONFINED PROPELLANT			X*		
CONFINED PROPELLANT			X*		
5.5.1.6 FRAGMENT INTRUSION - PROPELLANT RESPONSE TO:					
IMPACT (COLD PARTICAL)			X*		
THERMAL (HOT PARTICAL)			X*		
5.5.1.7 FRAGMENTATION ON IMPACT					
(HERCULES SHOT GUN TEST)			X*		
5.5.1.8 SENSITIVITY TO ADIABATIC COMPRESSION			X*		
5.5.1.9 SYMPATHETIC DETONATION				X	

5.0 PROPELLANT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
5.5.1.10 BLASTING CAP TEST			X		
5.5.1.11 CRITICAL DIAMETER			X		
5.5.1.12 CARD GAP TEST		X*			

APPENDIX 6.0
LINER INHIBITOR CHARACTERISTICS

6.0 LINER INHIBITOR CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.1 PHYSICAL/CHEMICAL PROPERTIES					
6.1.1 DENSITY		X			
6.1.2 COEF OF LINEAR EXPANSION		X			
6.1.3 THERMAL CONDUCTIVITY		X			
6.1.4 HEAT CAPACITY		X			
6.1.5 THERMAL DECOMPOSITION		X			
6.2 MECHANICAL PROPERTIES					
6.2.1 UNIAXIAL TENSILE (RATE, TEMP)			X		
6.2.2 BIAxIAL TENSILE PROPERTIES			X		
6.2.3 RELAXATION MODULUS			X		
6.2.4 COMPRESSIVE PROPERTIES			X		
6.2.5 LONG TERM LOAD PROPERTIES			X		

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.3 BOND CHARACTERISTICS					
6.3.1 PEEL TEST		X			
6.3.1.1 CASE/LINER		X			
6.3.1.2 PROPELLANT/LINER		X			
6.3.1.3 INSULATION/LINER		X			
6.3.2 SHEAR TEST		X			
6.3.3 THUMBNAIL TEST		X			
6.3.4 HARDNESS TEST (PENETROMETER)		X			
6.3.5 BOND-IN-TENSION TEST			X		
6.3.6 CREEP TEST			X		
6.3.7 VULNERABILITY TO CONTAMINANTS			X		
6.3.8 TRIAXIAL TENSION (PROPELLANT/ LINER)			X		
6.3.9 ADHESIVE FRACTURE ENERGY			X		
6.3.10 ADHESIVES		X*			
6.3.11 CONTACT ANGLE EFFECT OF APPLICATION METHODS		X*			
6.3.12 HUMIDITY EFFECTS		X*			

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.4 LINER PREPARATION CHARACTERISTICS					
6.4.1 MIXING PROCEDURES		X	X	X	
6.4.2 CONTAMINATION EFFECTS		X			
6.4.2.1 FROM ENVIRONMENT					
ANALYSIS			X		
CONTAMINATION LIMITS			X		
6.4.2.2 BOND INTERFACE CHANGES					
ANALYSIS			X		
VARIATION LIMITS			X		
6.5 SURFACE PREPARATION CHARACTERISTICS					
6.5.1 METHOD OF PREPARATION AND CLEANING		X			
6.5.2 HANDLING AFTER CLEANING		X			
6.5.3 SHELF LIFE AND STORAGE CONDITIONS		X			
6.5.4 WASHCOATS/BARRIER COATS		X			

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.6 APPLICATION CHARACTERISTICS					
6.6.1 PROCEDURE		X*	X*	X	
6.6.2 EQUIPMENT		X*	X*	X	
6.6.3 TEST FOR SURFACE PREPARATION			X		
6.6.4 TEMP/HUMIDITY CONTROLS		X			
6.6.5 RHEOLOGY		X			
6.6.6 REPRODUCIBILITY		X			
6.7 CURE CHARACTERISTICS					
6.7.1 TIME		X			
6.7.2 RHEOLOGY		X			
6.7.3 TEMPERATURE		X			
6.7.4 ENVIRONMENT		X			

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

[illegible]

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.9 COMPATIBILITY CHARACTERISTICS		X			
6.9.1 LINER INGREDIENTS					
SOLUBILITY					
TEMPERATURE STABILITY					
REACTIVITY/GASSING					
6.9.2 OTHER MATERIALS		X			
PROPELLANT					
ADHESIVES					
INSULATION					
BARRIER COATS					
6.9.3 INTERFACIAL PROPERTIES		X			
PROPELLANT/LINER					
LINER/INSULATION					
LINER/CASE					
6.9.4 COMPATIBILITY TESTS		X			

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEY	ENG DEV	LMTD PROD
6.10 PLUME CHARACTERISTICS					
6.10.1 INTERACTION CHARACTERISTICS			X*	X	
6.10.2 ANALYSIS		X*	X*	X	
6.10.3 LINER CONTRIBUTION		X*	X*	X	
6.11 EROSION CHARACTERISTICS					
6.11.1 BALLISTICS			X*	X	
6.11.2 INSULATION			X*	X	
6.11.3 CHAR FORMATION				X	

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.12 AGING CHARACTERISTICS					
6.12.1 SPECIMENS OF LINER STORED AT CHOSEN TEMPERATURE					
VISUAL CHECKS		X			
THUMBNAIL CHECKS		X	X		
6.12.2 DISSECTION SPECIMENS FROM AGED MOTORS				X	
6.12.3 BOND JOINT SPECIMENS		X*	X		
LINER/CASE		X*	X		
LINER/PROPELLANT		X*	X		
LINER/INSULATION		X*	X		
6.12.4 OFF GASSING		X			
6.12.5 DTA/DSC		x			
6.12.6 TEMPERATURE STABILITY			X		
TEMPERATURE CYCLING			X		
ACCELERATED			X		
LOW TEMPERATURE AGING			X		

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.12.7 ADHESIVES					
LOW TEMPERATURE BOND AND MECHANICAL CHARACTERISTICS		X			
HIGH TEMPERATURE BOND AND MECHANICAL CHARACTERISTICS		X			
6.13 TOXICOLOGY CHARACTERISTICS					
6.13.1 EXPOSURE LIMITS	X*	X			
6.13.2 IMMEDIATE DANGER CONCENTRATION	X*	X			
6.13.3 PERSONAL PROTECTION		X*	X		
6.13.3.1 CLOTHING & GLOVES		X*			
6.13.3.2 GOGGLES		X*			
6.13.3.3 RESPIRATOR		X*			
6.13.3.4 SPILL REACTION		X*			
6.13.4 EXPOSURE SYMPTOMS	X*	X			
6.13.5 ROUTES OF EXPOSURE	X*	X			
6.13.6 FIRST AID	X*	X			

6.0 LINER INHIBITOR CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
6.14 MATERIAL STORAGE AND HANDLING					
6.14.1 HAZARDS		X			
6.14.1.1 TOXICITY		X			
6.14.1.2 IGNITIBILITY		X			
6.14.1.3 CORROSIVITY		X			
6.14.1.4 REACTIVITY		X			
6.14.1.5 MATERIAL EXPLOSIVE CHARACTERISTICS		X			
6.14.2 STORAGE		X			
6.14.3 TRANSPORTATION			X*	X	
6.15 NBC SURVIVABILITY		X*	X*	X	
6.16 COST		X*	X		
6.17 FORMULATION		X			
6.18 MATERIAL SPECS REFER TO SECTION IX				X	X

APPENDIX 7.0
INSULATION CHARACTERISTICS

7.0 INSULATION CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.1 MANUFACTURING CHARACTERISTICS		X			
7.1.1 FORMULATION		X			
7.1.2 AVAILABILITY		X			
7.1.2.1 SOURCES					
7.1.2.2 PRODUCTION CAPACITY VS CONSUMPTION					
7.1.3 COST		X*	X		
7.1.4 MANUFACTURING PROCESSES		X*	X		

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.2 SAFETY/HAZARDS		X			
7.2.1 TOXICITY	X*	X			
7.2.1.1 STORAGE/HANDLING					
SKIN CONTACT					
VAPOR INHALATION					
7.2.1.2 COMBUSTION/EXHAUST PRODUCTS					
AIRBORNE GASSES					
AIRBORNE PARTICLES					
RESIDUE IN MOTOR					
7.2.1.3 MACHINERY OPERATIONS					
7.2.2 CORROSIVITY		X			
7.2.2.1 COMBUSTION/EXHAUST PRODUCTS					
AIRBORNE					
RESIDUE IN MOTOR					

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.3 APPLICATION AND USE					
7.3.1 SUBSTRATE PREPARATION		X			
7.3.1.1 CLEANING					
7.3.1.2 PRIMING					
7.3.1.3 PROCEDURES					
7.3.1.4 LIMITATIONS					
7.3.2 INSULATION PREPARATION		X			
7.3.2.1 CALENDERED					
CUTTING AND TRIMMING					
ORIENTATION CHARACTERISTICS					
DIMENSIONAL/FITTING EFFECTS					
SURFACE PREPARATION					
7.3.2.2 PRE-MOULDED					
SURFACE PREPARATION					
ADHESIVE CHARACTERISTICS					

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
BAKE-OUT					
7.3.2.3 MASTIC					
RHEOLOGY					
SURFACE PREPARATION					
7.3.2.4 WOUND ELASTOMERIC					
RHEOLOGY					
SURFACE PREPARATION					
7.3.3 PROCESS CHARACTERISTICS		X			
7.3.3.1 SCORCH					
7.3.3.2 PLASTICITY					
7.3.3.3 FLOW					
7.3.3.4 TACK					
7.3.3.5 TEAR STRENGTH					
7.3.4 INSTALLATION		X			
7.3.4.1 EQUIPMENT			X*	X*	

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.3.4 INSTALLATION (CONTD)					
7.3.4.2 PROCEDURES			X*	X*	
7.3.4.3 PRODUCTION FEASIBILITY			X*	X*	
7.3.4.4 CURE CHARACTERISTICS		X			
TIME/TEMPERATURE/ PRESSURE		X			
7.4 PHYSICAL PROPERTIES		X			
7.4.1.1 DENSITY					
7.4.1.2 PHASE/STATE CHANGES					
7.4.1.3 HARDNESS					

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.5 CHEMICAL PROPERTIES		X			
7.5.1 STRUCTURAL TYPE		X*			
7.5.2 CROSS-LINK DENSITY		X*			
7.5.3 CURE REACTIONS		X			
7.5.4 COMPATIBILITY		X			
OUTGASSING					
REACTIONS AT INTERFACE					
ABSORPTION OF LIQUIDS					
7.5.5 BASELINE DATA BANK		X*	X*	X*	
7.5.6 MOISTURE EFFECTS		X*	X		

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.6 MECHANICAL PROPERTIES		X			
7.6.1 CURED PROPERTIES					
7.6.1.1 TEMP-EFFECTS ON TENSILE STRENGTH, ELONGATION, MODULUS					
7.6.1.2 CREEP					
7.6.1.3 COMPRESSION SET					
7.6.1.4 HYDROSTATIC COMPRESSABILITY					
7.6.2 BOND PROPERTIES OVER TEMPERATURE RANGE			X		
7.6.2.1 BOND STRENGTH TO SUBSTRATE					
TENSILE					
PEEL					
7.6.2.2 BOND STRENGTH TO LINER/ PROPELLANT/OTHER INSULATOR					
TENSILE					
PEEL					
SHEAR					

7.0 INSULATION CHARACTERISTICS (CONTD)

[illegible]

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.7 THERMAL PROPERTIES		X			
7.7.1 LABORATORY DATA		X			
7.7.1.1 THERMAL EXPANSION					
7.7.1.2 THERMAL DIFFUSIVITY					
7.7.1.3 THERMAL CONDUCTIVITY					
7.7.1.4 SPECIFIC HEAT					
7.7.1.5 THERMOGRAVIMETRIC ANALYSIS					
7.7.1.6 ABLATION TEMPERATURE/ RATE					
7.7.1.7 RADIATION CHARACTERISTICS					
7.7.2 MOTOR TESTS					
7.2.1 EROSION DATA		X*	X		
7.2.2 CHAR CHARACTERISTICS					
7.2.3 PLUME EFFECTS					
7.7.3 BALLISTIC CONTRIBUTION			X		
7.7.4 ORIENTATION EFFECTS					

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.8.3 POST-CAST PROPERTIES (CONTD)					
MIGRATION AFTER CURE					
GAS PHASE MIGRATION					
7.8.3.2 AGING EFFECTS		X*	X		
EFFECTS OF TIME/TEMP AND HUMIDITY ON:					
CURED PROPERTIES					
BOND CHARACTERISTICS					
BASELINE DATA BANK					

7.0 INSULATION CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
7.8 STORAGE/SURVEILLANCE					
7.8.1 PRE-CURE CHARACTERISTICS		X			
7.8.1.1 SHELF LIFE					
7.8.1.2 STORAGE REQUIREMENTS					
7.8.2 PRE-CAST CHARACTERISTICS		X			
7.8.2.1 SHELF LIFE					
7.8.2.2 SURFACE TREATMENT REQUIREMENTS					
7.8.2.3 WINDOW OF CASTABILITY					
7.8.3 POST-CAST PROPERTIES		X*	X		
7.8.3.1 MIGRATION CHARACTERISTICS					
MIGRATING SPECIES					
TIME/TEMP RATE EFFECTS					
BALLISTICS EFFECTS					
BOND STRENGTH EFFECTS					
MIGRATION DURING CURE					

APPENDIX 8.0
IGNITER CHARACTERISTICS

8.0 IGNITER CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.1 COMPLETE IGNITER ASSEMBLY					
8.1.1 GENERAL CHARACTERISTICS					
8.1.1.1 FUNCTIONAL DELAY TIME			X		
8.1.1.2 PRESSURE-TIME HISTORY			X		
8.1.1.3 TIME TO FIRST PRESSURE			X		
8.1.1.4 IGNITION INTERVAL			X		
8.1.1.5 TIME TO ITEM OPERATIONAL PRESSURE			X		
8.1.1.6 TIME TO MAX. PRESSURE			X		
8.1.1.7 MAX PRESSURE			X		
8.1.1.8 PRESSURE RISE RATE			X		
8.1.1.9 OPERATIONAL REQUIREMENTS			X		
8.1.1.10 AGING CHARACTERISTICS			X*	X	X
8.1.1.11 BRISANCE		X	X	X	
8.1.1.12 RELATIVE IGNITABILITY		X*			
8.1.1.13 CALORIFIC OUTPUT	X*	X			

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEY	ENG DEV	LMTD PROD
8.1.1.14 DELIVERED TEMPERATURE PROFILE		X*			
8.1.1.15 RELIABILITY					
JOLT TEST			X*		
TUMBLE			X*	X	
40-FT DROP			X*	X	
TRANSVIBRATION			X*	X	
VACUUM			X*	X	
SALT SPRAY			X*	X	
STATIC			X*	X	
ENVIRONMENT & PERFORMANCE			X*	X	
JOLT FOR PRODUCT			X*	X	
TRANSPORTATION			X*	X	
TEMPERATURE & HUMIDITY			X*	X	
ENVIRONMENTAL TESTS			X*	X	

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.1.1.16 SIGNATURE					
FLASH		X*	X*	X	
SMOKE		X*	X*	X	
NOISE AND NOISE SENSITIVITY		X*	X*	X	
DEBRIS		X*	X*	X	
8.1.1.17 COST	X*	X*	X*	X*	

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.2 INITIATOR CHARACTERISTICS					
8.2.1 ELECTRICAL INITIATORS					
8.2.1.1 DELAY TIME AT FIRING CURRENT		X			
8.2.1.2 PRESSURE-TIME CHARACTERISTICS		X*	X*	X	
8.2.1.3 BRISANCE		X*	X*	X	
8.2.1.4 PREFIRE-CHARACTERISTICS					
ELECTRICAL					
BRIDGE RESISTANCE		X	X	X	
CASE-TO-LEAD RESISTANCE		X			
LEAK RATE			X		
POSTFIRE CHARACTERISTICS					
ELECTRICAL					
BRIDGE RESISTANCE			X*	X	
CASE-TO-LEAD RESISTANCE			X*	X	
LEAK NOTE			X		

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEY	ENG DEV	LMTD PROD
8.2.1.5 CALORIFIC OUTPUT			X		
8.2.1.6 RELATIVE IGNITION POTENTIAL			X*	X*	
8.2.1.7 RELIABILITY			X*	X	
8.2.1.8 NUCLEAR SUSCEPTIBILITY				X*	
8.2.1.9 SIGNATURE					
FLASH		X*	X*	X	
SMOKE		X*	X*	X	
NOISE		X*	X*	X	
DEBRIS		X*	X*	X	
8.2.1.10 COMPATIBILITY (IN SYSTEM)		X*	X*	X	
8.2.2 MECHANICAL INITIATORS					
8.2.2.1 FUNCTION TIME		X			
8.2.2.2 ALL-FIRE INPUT ENERGY			X		
8.2.2.3 FUNCTION RELIABILITY			X		
8.2.2.4 PRESSURE-TIME CHARACTERISTICS			X*		

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.2.2.5 BRISANCE		X*	X*	X	
8.2.2.6 RELATIVE IGNITION POTENTIAL			X*	X	
8.2.2.7 RELIABILITY			X*	X	
8.2.2.8 SIGNATURE					
FLASH		X*	X*	X	
SMOKE		X*	X*	X	
NOISE		X*	X*	X	
8.2.2.9 PRE-FIRE FIRE CHARACTERISTICS					
LEAK RATE			X		
MECHANICAL INTEGRITY		X*			
8.2.2.10 POST FIRE CHARACTERISTICS					
LEAK RATE			X		
MECHANICAL INTEGRITY		X			

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.2.3 LASER INITIATORS					
8.2.3.1 FUNCTION TIME			X		
8.2.3.2 FUNCTIONAL SUSCEPTIBILITY TO WAVE LENGTHS	X				
8.2.3.3 WINDOW OR FIBER OPTIC ATTENUATION		X			
8.2.3.4 GENERAL CHARACTERISTICS (SECT 8.1)					
8.2.4 SONIC INITIATORS					
8.2.4.1 GENERAL CHARACTERISTICS (SECT 8.1)					
8.2.4.2 RESONANCE CHARACTERISTICS (TEST GAS)		X			
8.2.4.3 RESONANCE CHARACTERISTICS (ATMOSPHERE)		X			
8.2.4.4 DIAPHRAGM					
HEAT TRANSFER		X			
MECHANICAL PROPERTIES		X			
8.2.5 EXPLOSIVE CORDS AND FUZES AS INITIATORS					
8.2.5.1 GENERAL CHARACTERISTICS (SECT 8.1)					
8.2.5.2 INITIATOR ENERGY		X			

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.2.5.3 VELOCITY OF REACTION		✓			
8.2.5.4 BRISANCE					
CONFINED			X		
UNCONFINED			X		
8.2.5.5 CORE LOAD					
TYPE AND AMOUNT			X		
8.2.5.6 CONFIGURATION LIMITS					
RADIUS OF CURVATURE			X*	X	
CROSS-OVER FOR PROPAGATION			X*	X	
GAP DISTANCE FOR PROPAGATION			X*	X	
8.2.5.7 CALORIFIC OUTPUT			X*		
8.2.5.8 MECHANICAL PROPERTIES			X*	X	
TENSILE TO NON-FUNCTIONING			X*	X	
MINIMUM FUNCTIONAL RADIUS			X*	X	
THERMAL LIMITS					

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.2.6 THRU-BULKHEAD INITIATORS					
8.2.6.1 GENERAL CHARACTERISTICS (SECT 8.1)					
8.2.6.2 PRE-FIRE, FIRE REQUIREMENTS					
PRESSURE RETENTION		X			
STRUCTURAL INTEGRITY		X			
POST-FIRE CHARACTERISTICS					
PRESSURE RETENTION		X			
STRUCTURAL INTEGRITY		X			
8.2.6.3 INPUT ENERGY (DONOR)		X*	X		
8.2.6.4 OUTPUT ENERGY (ACCEPTOR)		X*	X		
8.2.6.5 FUNCTIONAL TIME		X*	X		
8.2.6.6 RELIABILITY		X*	X		

8.0 IGNITER CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
8.3 CLOSURE CHARACTERISTICS					
8.3.1 GENERAL REQUIREMENTS (SECT 9)					
8.3.1.1 RELEASE PRESSURE		X*	X		
8.3.1.2 RELEASE TIME			X*		
8.3.1.3 SYSTEM REQUIREMENTS			X*	X	
SIGNATURE					
DEBRIS			X*	X	
NOISE			X*	X	
8.3.1.4 INTERFACING (SPECIFIC)			X		
8.3.1.5 COMPATIBILITY (SPECIFIC)		X*	X		
8.3.1.6 MECHANICAL PROPERTIES		X*	X		
8.3.1.7 PERMEABILITY					
MOISTURE		X*	X		
SYSTEM ENVIRONMENTS		X*	X		

APPENDIX 9.0
INGREDIENT CHARACTERISTICS

9.0 INGREDIENT CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.1 PHYSICAL PROPERTIES					
9.1.1 PHYSICAL					
9.1.1.1 PHYSICAL STATE	X				
9.1.1.2 COLOR	X				
9.1.1.3 VOLATILITY	X				
9.1.1.4 VISCOSITY	X*	X			
9.1.1.5 HARDNESS	X*				
9.1.1.6 HYGROSCOPICITY	X				
9.1.1.7 MODULUS OF ELASTICITY	X*				
9.1.1.8 DENSITY	X				
9.1.1.9 MOLECULAR WEIGHT/ EQUIVALENT WEIGHT	X				
9.1.1.10 VAPOR PRESSURE		X			
9.1.1.11 MISCIBILITY	X				
9.1.1.12 BURNING RATE	X*				
9.1.1.13 OXYGEN BALANCE (CO/CO ₂)	X				

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.1.2 THERMAL CHARACTERISTICS					
9.1.2.1 MELTING POINT	X				
9.1.2.2 BOILING POINT	X				
9.1.2.3 DECOMPOSITION TEMPERATURE (DTA)	X				
9.1.2.4 SUBLIMATION	X				
9.1.2.5 FLASH POINT	X				
9.1.2.6 THERMAL CONDUCTIVITY	X*				
9.1.2.7 COEFFICIENT OF THERMAL EXPANSION	X*				
9.1.2.8 THERMAL DIFFUSIVITY	X*				
9.1.2.9 THERMAL STABILITY	X*				
9.1.2.10 GLASS TRANSITION TEMPERATURE	X				
9.1.2.11 CRITICAL TEMPERATURE		X*			
9.1.2.12 HEAT CAPACITY		X*			

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.1.3 CRYSTAL/OPTICAL PROPERTIES					
9.1.3.1 CRYSTALLINE FORMS		X*			
9.1.3.2 PHASE TRANSITIONS	X*				
9.1.3.3 OPTICAL ROTATION		X*			
9.1.3.4 MOLAR REFRACTION		X*			
9.1.3.5 REFRACTIVE INDEX		X*			
9.1.3.6 ELEMENTARY AND UNIT CELL DIMENSIONS		X*			
9.1.3.7 LATTICE DEFECTS		X*			
9.1.3.8 EPITAXIAL		X*			
9.1.4 ELECTRICAL CHARACTERISTICS					
9.1.4.1 ELECTRICAL CONDUCTIVITY		X*			
9.1.4.2 DIELECTRIC CONSTANT		X*			
9.1.4.3 MAGNETIC SUSCEPTIBILITY		X*			
9.1.4.4 ELECTROSTATIC CHARGING		X*			

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.1.5 THERMODYNAMIC PROPERTIES					
9.1.5.1 HEAT OF FORMATION	X*				
9.1.5.2 HEAT CAPACITY	X*				
9.1.5.3 HEAT OF COMBUSTION	X				
9.1.5.4 HEAT OF EXPLOSION	X*				
9.1.5.5 HEATS OF TRANSITION/ TEMPERATURE	X				

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.1.6 SPECIAL PROPERTIES - POLYMERS					
9.1.6.1 SOLUBILITY PARAMETER	X*				
9.1.6.2 ΔG MIX, ΔH MIX	X*				
9.1.6.3 VIRIAL COEFFICIENT	X*				
9.1.6.4 UPPER AND LOWER CRITICAL SOLUTION TEMPERATURE	X*				
9.1.6.5 THETA STATES	X*				
9.1.6.6 SWELLING RATIOS	X*				
9.1.6.7 INTRINSIC VISCOSITY	X*				
9.1.6.8 SHEAR MODULUS		X*			
9.1.6.9 HEAT CAPACITY		X*			
9.1.6.10 MOLECULAR WEIGHT AND DISTRIBUTION	X				

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.2 CHEMICAL PROPERTIES					
9.2.1 SOLUBILITY/MISCIBILITY	X				
9.2.2 COMPATIBILITY	X				
9.2.3 CHEMICAL STABILITY	X				
9.2.4 REACTIVITY	X				
9.2.5 CHEMICAL IDENTIFICATION					
9.2.5.1 NAME	X				
9.2.5.2 STRUCTURE	X				
9.2.5.3 EMPIRICAL FORMULA	X				
9.2.5.4 FORMULA WEIGHT	X				
9.2.6 WETTABILITY (CONTACT ANGLE)		X*			
9.2.7 VACUUM STABILITY (TALIANI)		X*			
9.2.8 FUNCTIONALITY & DISTRIBUTION	X				
9.2.9 PHOTSENSITIVITY	X*				
9.2.10 REACTIVITY RATIO (COPOLYMER FORMATION)	X				

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.2.11 REACTIVITY RATIO (MIXED PREPOLYMERS)		X*			
9.2.12 ASSAY	X				
9.2.13 ACIDITY	X				
9.3 HAZARD/SAFETY CHARACTERISTICS					
9.3.1 IMPACT SENSITIVITY	X				
9.3.2 FRICTION INITIATION	X				
9.3.3 SPARK INITIATION	X				
9.3.4 CARD GAP VALUE		X*			
9.3.5 FLAMMABILITY INDEX	X				
9.3.6 TOXICITY ASSESSMENT	X				
9.3.7 CORROSIVITY		X*			
9.3.8 DOT CLASSIFICATION		X			
9.3.9 MILITARY CLASSIFICATION		X			
9.3.10 RECLAMATION/DISPOSAL PROCEDURES		X*			
9.3.11 PYROPHORIC	X				

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.3.12 HYPERGOLIC	X				
9.3.13 AUTO IGNITION POINT		X*			
9.3.14 STORAGE AND HANDLING ASSESSMENT	X				
9.4 AVAILABILITY/COST					
9.4.1 PRODUCTION					
9.4.1.1 MANUFACTURING METHOD		X			
9.4.1.2 CAPACITY/VOLUME		X			
9.4.1.3 ENVIORNMENTAL REGULATIONS/COMPLIANCE		X			
9.4.1.4 WASTE HANDLING PROCEDURES		X			
9.4.2 SOURCE					
9.4.2.1 SUPPLIER, IMPORTERS, MANUFACTURER		X			
9.4.2.2 ALTERNATE MATERIALS	X	X	X*		
9.4.2.3 USERS OTHER THAN DOD		X			
9.4.2.4 DOD CAPABILITY TO PRODUCE & STOCKPILE		X			

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	COM RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.4.3 COST					
9.4.3.1 UNIT COST	X*	X			
9.4.3.2 CAPITALIZATION (NEW INGREDIENTS)	X*				
9.5 QUALITY					
9.5.1 PURITY	X*				
9.5.2 IMPURITIES	X*				
9.5.3 ANALYTICAL PROCEDURES	X*	X*	X*	X	
9.5.4 SPECIFICATIONS		X*	X*	X	
9.5.5 REFERENCE DATA					
9.5.5.1 DTA AND/OR DSC		X*	X*	X*	
9.5.5.2 TGA		X*	X*	X*	
9.5.5.3 X-RAY DIFFRACTOMETRY		X*	X*	X*	
9.5.5.4 INFRARED SPECTROPHOTOMETRY		X*	X*	X*	
9.5.5.5 UV/VISIBLE		X*	X*	X*	
9.5.5.6 GAS CHROMATOGRAPHY		X*	X*	X*	

9.0 INGREDIENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
9.5.5.7 LIQUID CHROMATOGRAPHY ION CHROMATOGRAPHY		X*	X*	X*	
9.5.5.8 MASS SPECTROMETRY		X*	X*	X*	
9.5.5.9 NMR SPECTROMETRY		X*	X*	X*	
9.5.5.10 PARTICLE SIZE DISTRIBUTIONS/GEOMETRY		X*	X*	X*	
9.5.5.11 SPECIFIC SURFACE AREA		X*	X*	X*	
OTHER TESTS AS APPROPRIATE		X*	X*	X*	
9.5.6 MOISTURE LIMITS	X*	X*			
9.5.7 APPEARANCE	X*				
9.6 AGING/STORAGE/SURVEILLANCE					
9.6.1 TEMPERATURE LIMITS	X				
9.6.2 SHELF LIFE (ACTUAL/PREDICTED)	X	X			
9.6.3 COMPATIBILITY WITH MATERIALS AND CONTAINERS	X				
9.6.4 STORAGE ENVIRONMENT	X				
9.6.5 SURVEILLANCE PROCEDURE	X*	X*			

APPENDIX 10.0

ENERGY MANAGEMENT CHARACTERISTICS

10.0 ENERGY MANAGEMENT CHARACTERISTICS

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
10.1 PERFORMANCE					
10.1.1 ANALYSIS PREDICTIONS	X				
10.1.2 PROOF OF PRINCIPLE		X			
10.1.3 FEASIBILITY DEMO			X		
10.1.4 PFRT AND QUAL				X	
10.1.5 1st ARTICLE					X
10.2 COST					
10.2.1 SIMILARITY COMPARISON	X	X			
10.2.2 PARAMETRIC ANALYSIS			X		
10.3 RELIABILITY					
10.3.1 ANALYSIS PREDICTIONS	X	X			

10.0 ENERGY MANAGEMENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
10.4 SUITABILITY (ENVIRONMENTAL)					
10.4.1 AMBIENT CONDITIONS	X	X			
10.4.2 TEMPERATURE EXTREMES, VIBRATION, DROP & ETC.			X		
10.5 SAFETY/HAZARDS					
10.5.1 LAB AND COMPONENT TEST	X	X			

10.0 ENERGY MANAGEMENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
10.6 THRUST MAGNITUDE CHARACTERISTICS					
10.6.1 SYSTEM INTERFACE CHARACTERISTICS					
10.6.2 INITIATION CONSTRAINTS					
10.6.3 TURN-DOWN RATIO					
10.6.4 FORCE RATIO					
10.6.5 RESPONSE TIME					
10.6.6 DURATION					
10.6.7 COST					
10.6.8 RELIABILITY					
10.6.9 SUITABILITY (ENVIRONMENTAL)					
10.6.10 PRODUCABILITY					
10.6.11 SAFE/HAZARDS					

10.0 ENERGY MANAGEMENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
10.7 THRUST VECTOR CONTROL CHARACTERISTICS					
10.7.1 GENERAL CHARACTERISTICS					
10.7.1.1 OPERATING MODE (BOOST/SUSTAIN)					
10.7.1.2 OPERATING DURATION					
10.7.1.3 NUMBER OF INDEPENDENT CONTROL AXIS					
10.7.1.4 DUTY CYCLE					
10.7.1.5 THRUST-TIME ENVELOPE					
10.7.1.6 FORCE RATIO					
10.7.1.7 EFFICIENCY FACTORS					
10.7.1.8 MISSILE RESPONSE RATE					
10.7.1.9 ACTUATOR RESPONSE RATE					
10.7.1.10 SEAL CHARACTERISTICS					
10.7.1.11 COST					
10.7.1.12 RELIABILITY					
10.7.1.13 SUITABILITY (ENVIRONMENTAL)					

10.0 ENERGY MANAGEMENT CHARACTERISTICS (CONTD)

ACTIVITY	CON RES	EXPL DEV	ADV DEV	ENG DEV	LMTD PROD
10.7.1.14 PRODUCABILITY					
10.7.1.15 SAFE/HAZARDS					
10.7.1.16 TRAVEL					
10.7.1.17 ALIGNMENT					
10.7.1.1* *DEFLECTOR STALL TORQUE					
10.7.1.19 DEFLECTOR SLEW RATE					
10.7.1.20 DEFLECTOR INERTIA					
10.7.1.21 DEFLECTOR FREQUENCY RESPONSE					
10.7.1.22 CROSS COUPLING					
10.7.1.23 BLEED FLUID CHARACTERISTICS					
10.7.1.24 EROSION					
10.7.1.25 CENTROID OF THRUST					

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	Dr. Rhoades	1
	Mr. B. J. Cobb	1
-RK,	Dr. W. D. Stephens	100
	Mr. D. J. Ifshin	1
-RKA,	Mr. A. R. Maykut	1
-RKF,	Mr. A. Stokes	1
	Mr. J. M. Tate	1
-RKK,	Mr. E. J. Palm	1
-RKL,	Mr. W. W. Wharton	1
	Mr. S.P.D. Smith	1
-RKP,	Mr. T. H. Duerr	1
	Mr. W. S. Crownover	1
-LP,	Mr. Voigt	1
-RPR		5
-RPT		1

END

FILMED

3-85

DTIC